CONSTRUCTION STANDARD SPECIFICATION

SECTION 16521

EXTERIOR LIGHTING UNITS

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EXTERIOR LIGHTING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes furnishing and installing exterior lighting units (metal poles and luminaires) as complete assemblies designed to provide optimal lighting on the ground for safe and secure pedestrian and vehicle travel. For specific requirements for lamps, ballasts and accessories refer to the drawings. Pole foundation details including reinforcing, and anchor bolts are also shown on the drawings.

B. This section is applicable to roadway, area, and security lighting. It is not applicable to high mast lighting 60 feet (18.3 m.) or greater in height, nor is it applicable to hazardous locations, nor is it applicable to building-mounted lighting covered under Sandia Construction Standard Specification 16514.

1.2 REFERENCES

A. Section 02200, "Earthwork" for excavation and backfilling for poles and foundations.

B. Section 03300, "Cast-In-Place Concrete" for pole foundations.

C. Section 16001, "Electrical Work".

D. Standard drawing, WJ5010STD, Exterior Lighting Details.

E. Standard drawing, WJ6001STD, Exterior Lighting Equipment Schedule.

F. International Dark Sky Association, Information Sheet 122, Examples of Good and Bad Lighting Fixtures

G. New Mexico Night Sky Protection Act (NMSA 74-12-1)

1.3 DEFINITIONS

A. Luminaire: A complete lighting unit. Luminaires include a lamp or lamps and parts required to distribute the light, position and protect lamps, and connect lamps to the power supply. Also called a Fixture.

B. Lighting Unit: A luminaire, or an assembly of luminaires with a common support, including a pole or bracket plus mounting and support accessories.

C. Full Cutoff: No direct uplight emitted from the fixture (0% light output at 90° from vertical (nadir) and <10% at 80° from vertical (nadir).

1.4 SUBMITTALS

A. General: Submit the following in accordance with the conditions of the contract and Section 01330, "Submittal Procedures".

B. Product Data: Submit product data describing fixtures, lamps, ballasts, poles, and accessories. Arrange product data for fixtures in order of designation. (Note: Where substitute lighting equipment and devices are proposed, the contractor shall be responsible for submitting a complete lighting level study to satisfy Sandia National Laboratories, SNL, that the substitute equipment is equivalent to what was specified.) Include data on features, poles, accessories, and the following:

1. Outline drawings of fixtures and poles indicating dimensions and principal features. Include cable support and grounding details.

2. Effective Projected Area (EPA) of each luminaire including arm, brackets, etc., and maximum allowable EPA of each pole.

3. Pole base and bolt requirements and special installation instructions.

4. Certification of welder and certification of steel. Also provide weld procedure specification and procedure qualification record.

5. Electrical ratings and photometric data (isolux diagrams) with certified results of independent laboratory tests.

6. Product certifications signed by manufacturers of lighting units certifying that their products comply with specified requirements.

7. Submit details of in-line fuseholder/fuse(s) if an equal but different type than specified in Section 2.05 is proposed.

8. Maintenance data for products for inclusion in Operating and Maintenance Manual.

9. Written report of site test data (see Section 3.05).

10. All calculations showing compliance with AASHTO.

C. Samples: Submit samples for verification purposes:

1. A sample of each individual fixture type shall be furnished when requested by the Sandia Designated Representative (SDR).

2. Submit samples (a cut piece) of finished materials when requested by the SDR.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: The manufacturer(s) shall be regularly engaged in the manufacture of exterior lighting units of the types and sizes required, whose products have been in satisfactory use in similar service for not less than ten (10) years.

B. Installer's Qualifications: The installer shall have at least three (3) years successful installation experience on projects with similar external lighting units. Submit proof when requested by SDR.

C. Listing and Labeling: All luminaires and accessories shall be listed and labeled for their indicated use and location by a "nationally recognized testing laboratory" as defined in OSHA Regulation 1910.7. The terms "listed" and "labeled" are defined in the National Electrical Code, Article 100.

1.6 DELIVERY, STORAGE AND, HANDLING

A. Inspect poles and luminaires for visual damage. All damaged poles and luminaires must be repaired or replaced by the contractor prior to installation. Whether damaged poles and luminaires are repaired or replaced shall be at the discretion of the SDR. Store luminaires in original containers and as directed by the manufacturer. Store poles on decay-resistant treated skids at least 1 ft. (0.31 m) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings until just before pole installation. Handle poles with web fabric straps or special rope used for this purpose and approved by the SDR.

1.7 WARRANTY

Submit manufacturer's and installer's warranty stating that all lighting equipment furnished under this contract shall be guaranteed against defective design, materials, and workmanship for the full warranty time, which is standard with the manufacturer or supplier, but in no case less than one year from the date of system acceptance. Pole finish of lighting units shall have a warranty period of three years. The warranty shall be mutually executed by the manufacturer and the installer, agreeing to replace light poles and luminaires exhibiting metallic damage such as cracks and failure of finish. Finishes shall be warranted against perforation or erosion due to weathering. Color retention shall be warranted against fading, staining, and chalking due to effects of weather and solar radiation.

PART 2 - PRODUCTS

2.1 LUMINAIRE COMPONENTS, GENERAL

A. Provide full cutoff luminaires in conformance with the New Mexico Night Sky Protection Act, unless specifically exempted on the Drawings.

B. Metal Parts: Free from burrs and sharp edges and corners.

C. Sheet Metal Components: Corrosion-resistant aluminum, except noted otherwise on the drawings. Form and support to prevent warping and sagging.

D. Housings: One piece die cast aluminum with die cast door frame. Provide filter/breather for enclosed fixtures. A metallic barrier shall be provided between the optical chamber and electrical compartment.

E. Doors, Frames, and Other Internal Access Provisions: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position. Provide for door removal for cleaning or replacing lens. Arrange for door opening to disconnect ballast. Ballast assembly shall be removable without need for tools.

F. Exposed Hardware Material: Stainless steel.

G. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

H. Plastic Parts: Resistant to yellowing and other changes due to aging and exposure to heat and UV radiation.

I. Lenses and Refractors: Materials are indicated on drawings. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor mounting in fixture doors.

J. Photoelectric Controls: Materials and controls will be indicated on drawings.

K. Effective Projected Area (EPA) of luminaire including arm, brackets, etc., shall not exceed 2 square feet (0.186 m^2).

L. All electrical components shall be mounted on ballast tray for easy removal. Mogul base socket to be mounted in optical chamber and be fully gasketed. Socket to be 4 KV pulse rated for high pressure sodium and metal halide lamps. Ballast tray shall support ballast and starter and shall be securely fastened to the housing for maximum thermal contact. Tray shall have connectors to allow removal of ballast assembly from housing without cutting wires.

2.2 HIGH-INTENSITY-DISCHARGE (HID) LUMINAIRES

A. Luminaires: Conform to UL 1572, "High-Intensity-Discharge Lighting Fixtures."

B. Ballasts: Conform to UL 1029, "High-Intensity-Discharge Lamp Ballasts" and ANSI C82.4, "Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)." Provide regulating high-power-factor type, unless

otherwise indicated. The ballast shall be designed to accommodate +/- 10% variation in line voltage and have a power factor of 0.9 or better.

1. Operating voltage shall match system voltage.

2. Single-Lamp Ballasts: Minimum starting temperature of minus 30 deg C.

3. Construct ballasts so open circuit operation will not reduce the average life.

4. High-Pressure Sodium (HPS) Ballasts: Equipped with a solid-state igniter/starter having an average life in the pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.

5. When specified on the drawings, provide auxiliary, instant-on quartz system for luminaires. Arrange lamp, socket, and controls for automatic switching of quartz lamp when the luminaire is initially energized, and when momentary power outages occur. Turn quartz lamp off automatically when lamp reaches approximately 60 percent light output. Mount components internal to the ballast and independent of the incoming line voltage.

2.3 LUMINAIRE SUPPORT COMPONENTS

A. Pole-Mounted Luminaires: Conform to AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals." Submit all combined stress ratio (CSR) calculations.

B. Wind-Load Strength: 100 mph (160.9 km/h) and 1.3 gust factor for total support assembly, including pole, base, and anchorage, where used, to carry the fixtures, supports, and appurtenances at the indicated heights above grade without deflection or whipping.

Vibration dampers shall not be utilized.

C. Arm, Bracket, and Tenon Mount Materials: Match requirements of the poles.

D. Mountings, Fastenings, and Appurtenances: Corrosion-resistant components compatible with the poles and fixtures that will not cause galvanic action at contact point. Provide mountings that will correctly position the luminaire to provide the indicated light distribution.

E. Poles:

1. Shafts: True round tapered steel, 11-gauge minimum, with heights as specified on the drawings (multi-sided poles are not acceptable). Taper shall be uniform and approximately 0.14 inches per foot (1.17 cm per meter). Poles shall be one-piece steel tubing with no circumferential splices conforming to ASTM A 500, Grade B, carbon steel with a minimum yield of 55000 psi (379,170 KPa) after fabrication.

2. Pole Bases: Anchor slip-on flange type with galvanized steel hold-down or anchor bolts, leveling nuts, and base covers. Base covers shall be a two piece carbon steel secured with at least two screws. Anchor base shall be fabricated from structural quality hot rolled carbon steel plate with yield strength of

36,000 psi (248,184 KPa). The base plate shall telescope the pole shaft and be circumferentially welded top and bottom. Provide slotted bolt holes to accommodate a ±0.5" (±1.27 cm) variation in nominal bolt circle.

3. Anchor bolts shall be fabricated from hot rolled carbon steel bar with minimum yield strength of 55,000 psi (379,170 KPa). Bolts shall have "L" bend at one end and shall be galvanized for at least 12 inches (30.48 cm) on threaded end. Four bolts, eight galvanized nuts and eight galvanized washers shall be provided per pole.

4. Handholes shall be reinforced, oval shaped, approximately 4 inches (10.16 cm) wide by 6 inches (15.24 m), with matching rain tight steel cover and attachment screws and centerline located approximately 18 inches (45.72 cm) above the base plate. For grounding purposes, two listed and labeled ground lugs shall be welded to the inside of the pole at the handhole location. The physical size of the ground lugs shall be kept to a minimum due to space limitations. One ground lug shall be suitable for connecting a minimum of two #14 AWG (2.08 mm^2) through #10 AWG (5.26 mm^2) solid or stranded copper conductors and the other suitable for connecting a minimum of two #8 AWG (8.37 mm^2) through #2 AWG (33.62 mm^2) stranded copper conductors.

5. Provide steel arms or brackets as noted on the drawings: Pole arms shall be fabricated from 2-inch (5.08 cm) pipe (except noted otherwise on the drawings), continuously welded to pole attachment plate and having span and rise as indicated.

6. Pole Brackets shall be designed to match pole metal. Provide cantilever brackets without underbrace, in the sizes and styles indicated, with straight tubular end section to accommodate the fixture.

7. Furnish pole-top tenons where required or indicated on the drawings and fabricated to support the luminaire(s) securely to the pole top.

8. Removable overlapping pole caps shall be provided.

9. Furnish a steel transformer base, 20” high, with each pole.

2.4 LAMPS

Conform to ANSI Standards, C78 series, applicable to each type of lamp. Provide luminaires with lamps indicated on the drawings.

2.5 FINISH

A. Metal Parts: All exterior surfaces shall be factory thermoset polyester powder coated dark bronze, 2.5 mil (0.00635 cm) nominal thickness, except noted otherwise on the drawings. (Interior of poles, arms, brackets, etc. shall have a factory-applied rust-inhibiting coating.) Finish shall be applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and similar defects. Remove poles, luminaires, and accessories showing evidence of corrosion or finish failure during Project warranty period and replace with new items.

B. Other Parts: Manufacturer's standard finish except as otherwise indicated on the drawings.

C. All paints and finishes shall be lead-free.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Set units plumb, square, level, and secure according to manufacturer's written instructions and shop drawings. Install wiring and connections in accordance with the drawings. All scratches in pole and fixture finish shall be touched up with manufacturer's furnished matching paint to the satisfaction of the SDR.

B. Pole Installation: Use fabric web slings (not chain or cable) to raise and set poles or use special rope approved for this purpose by the SDR.

C. Luminaire Attachment: Fasten to indicated structural supports per manufacturer's recommendation.

3.2 FIELD WIRING

A. Wiring between luminaire and connections at transformer base (including grounding conductor) shall be Type UF multiconductor cable, #14 AWG (2.08 mm^2) copper conductors (unless a larger ampacity cable is required), with number of conductors as shown on the drawings. The Type UF cable shall be supported at the top of the pole by means of a suitable "basket" type cable grip as manufactured by Kellems or equal approved by the SDR. The cable grip shall relieve the weight of the cable at the terminal block connections to the luminaire and prevent cable damage. A suitable hook or similar support shall be welded to the inside top of the pole for attaching the cable grip. The cable support shall be accessible from the top of the pole. Submit details of the cable supporting method for approval.

B. Wiring from transformer base to transformer base (including grounding conductor) shall be Type USE-2 or XHHW-2 cable, #6 AWG copper conductors (unless a larger cable is required for voltage drop or ampacity), with number of conductors as shown on the drawings.

C. Suitable insulated terminal blocks for connection of the above Type UF cable (including ground conductor), shall be provided in the luminaire. The design of the

luminaire shall be such that high temperature fixture wire is not required between the luminaire and the Type UF cable conductors.

D. Install a listed in-line fuseholder and fuse in each light pole at the transformer base location for all ungrounded conductors. An insulating/waterproofing boot shall be installed on both the line and load sides with electrical tape installed at the interface of each conductor and end of boot per manufacturer's instructions. A type CC non-time-delay, rejection type fuse shall be installed in each fuseholder. Size of fuse and size/type of line and load side conductors are shown on the drawings. Provide adequate load and line side conductor slack in the form of U-bends at each in-line fuseholder. Breakaway type in-line fuseholders shall only be installed where indicated on the drawings.

E. Fuseholders and fuse shall be manufactured by Littelfuse, type LEC or approved equal.

F. Install a Raychem GelCap Splice Kit (part number GelCap-SL-2/0-3Hole) at the transformer base from the #2 line conductor to the in-line fuse holder and on the #2 line conductors that splice through the transformer base. Install splices per the manufacturer’s instructions.

3.3 CONCRETE FOUNDATIONS

Construct concrete foundations conforming to Section 03300, "Cast-In-Place Concrete." Comply with details shown on drawings and manufacturer's recommendations for reinforcing, anchor bolts, nuts, and washers. Note: In parking lots, top of concrete foundation shall be at least 30 inches above finished grade except shown otherwise on the drawings.

3.4 GROUNDING

Ground fixtures and metal poles according to the NEC and as shown on the drawings. Unless otherwise noted on the drawings, install 3/4 inch (1.91 cm) diameter (minimum) copperclad ground rod at each pole, and connect to pole ground lug using #2 AWG (33.62 mm^2) copper conductor. Length of ground rod shall be 10 feet (3.048 m) vertically in the concrete foundation. Bond ground rod to reinforcing bars in the concrete foundation. Top of ground rod shall extend 3” above the concrete surface.

3.5 BALLAST INSTALLATION

Connect ballast transformer taps, if provided, to maintain ballast voltage within manufacturer's recommended tolerance.

3.6 FIELD QUALITY CONTROL

A. Inspection: Inspect installed units for damage or malfunction and take corrective action as required. Ensure that lighting units are in first-class condition, completely lamped, cleaned, and finish is in excellent condition.

B. Tests: Provide appropriate instruments to make and record the following test results:

1. Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source. Measure power demand on the circuit after warm-up.

2. Measure light intensity and uniformity at locations where specific illumination performance is indicated on the Drawings and produce isolumen plots as directed by the SDR. Use photometers with calibration referenced to NIST standards.

3. Check for compliance with the New Mexico Night Sky Protection Act and correct mounting and component alignment as necessary.

4. Check for excessively noisy ballasts and correct as necessary.

5. Replace or repair damaged and malfunctioning units (including excessively noisy ballasts), correct as necessary, and retest as directed by the SDR.

6. Submit written report of tests indicating actual illumination levels compared to the Drawings.

C. Identification: Each pole shall have a 1 inch (2.54 cm) wide (nominal) identification tag. Identifying each pole per contract drawings and/or as directed by the SDR. Tags shall be black numbers and/or letters on yellow background as applicable, 1 1/2" inches (3.81 cm) high, reflective pressure sensitive, Almetek brand or equal.

3.7 ADJUSTING AND CLEANING

Clean components on completion of installation. Use methods and materials recommended by manufacturer. Where applicable, adjust aimable fixtures to provide required light intensities.

END OF SECTION